PATENT ABSTRACTS OF JAPAN

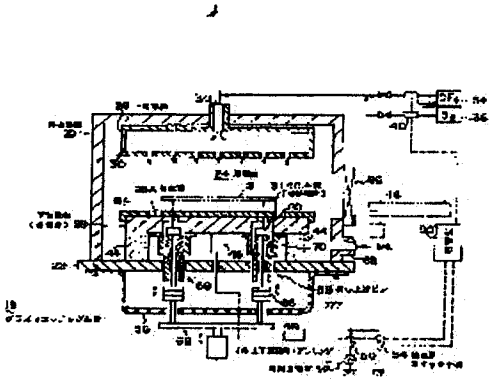
(11)Publication number : **07-074231**
(43)Date of publication of application : **17.03.1995**

(51)Int.Cl. H01L 21/68
C03C 15/00
C30B 33/00
H01L 21/3065

(21)Application number : **05-239129**
(22)Date of filing : **31.08.1993**

(71)Applicant : **TOKYO ELECTRON LTD**
TOKYO ELECTRON YAMANASHI KK
(72)Inventor : **TOMOYOSHI TSUTOMU**

(54) TREATMENT APPARATUS AND ITS USAGE METHOD



(57)Abstract:
PURPOSE: To remove an electric charge from the back of an object to be treated by installing a switch means for grounding a push-up pin and a lower-part electrode before the object is pushed up after the object has been treated.
CONSTITUTION: After a plasma treatment has been finished, a switch 50 for a power supply is turned off, the application of a high-frequency voltage to a lower-part electrode 28 is stopped, and the generation of a plasma is stopped. A switch means 54 for grounding is turned on, and the lower-part electrode 28 and push-up pins 58 are grounded via power-supply line 48 and a power- supply plate 46. An air cylinder 14 for up-and-down drive is driven, the individual push-up pins 58 are raised, four corners on the back of an LCD substrate S are brought into contact with tip parts of pin bodies 60, and the LCD substrate S is pushed up as a whole. At this time, when the LCD substrate S is separated from the lower-part electrode 28, an electric charge is generated in the LCD substrate S due to an exfoliation electrification phenomenon. However, the generated electric charge immediately escapes via the push-up pins 58 which are grounded, and it is possible to restrain the LCD substrate S from being electrified.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] In the processor which the plurality made possible by frequent appearance towards said installation side side from said installation base side pushes up at the time of carrying in and taking out of said processed object, and supported said processed object by the pin while having the installation base which lays the processed object which consists of a dielectric on an installation side The processor which is after processing of said processed object and is characterized by constituting so that it may have a switching means for touch-down for grounding said push raising pin, before pushing up said processed object by said push raising pin.
[Claim 2] The processor according to claim 1 characterized by connecting with said installation base possible [turning on and off of the RF generator for plasma generating].
[Claim 3] Said switching means for touch-down is a processor according to claim 1 or 2 characterized by constituting so that said switching means for touch-down may turn on before being prepared in said push raising pin, said push raising pin's going up and this tip's contacting said processed object.
[Claim 4] In the operation of the processor made as [take / perform predetermined processing to the processed object which consists of a dielectric laid on the installation side of the installation base of the processing interior of a room, and the plurality which penetrates said installation base pushes up, push up by the pin, and] Operation of the processor characterized by constituting so that said switching means for touch-down may be turned ON and said push raising pin may be grounded before it establishes the switching means for touch-down for grounding said push raising pin and said push raising pin contacts said processed object.
[Claim 5] Said processing is the operation of the processor according to claim 4 which is plasma treatment and is characterized by constituting so that impression of the high-frequency voltage for plasma generating may be stopped in advance of the touch-down of said push raising pin.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the processor which performs plasma etching and membrane formation processing to a glass substrate etc., and its operation.
[0002]
[Description of the Prior Art] In order to perform plasma-etching processing and membrane formation processing to front faces, such as a LCD substrate which consists of a semi-conductor wafer or glass, generally, various kinds of processors are known. Here, taking the case of plasma treatment equipment, it explains as equipment for performing plasma treatment to the LCD substrate front face which consists of glass which is a dielectric.
[0003] Drawing 5 shows the outline block diagram of the conventional plasma treatment equipment

for LCD substrates, rectangle-like the up electrode 4 and the lower electrode 6 counter in parallel in the processing room 2, this kind of processor is arranged, and the LCD substrate S of the shape for example, of a rectangle is laid on the susceptor as a lower electrode 6. And if it is in either the above-mentioned up electrode 4 or the lower electrode 6 and the example of illustration, RF generator 10 for plasma generating is connected to the lower electrode 6 through the open/close switch 8 for plasma impression, and the plasma will be generated among two poles with the high-frequency voltage from this power source.

[0004] Moreover, four corners of the lower electrode 6 are made to penetrate this, plurality pushes up, the pin 12 is formed in the vertical direction possible [frequent appearance], and each pin 12 moves up and down in common by the air cylinder 14 for a vertical drive. therefore -- this -- it pushes up, and you move a pin 12 up and down, make it go up and down the LCD substrate S, and the LCD substrate S is delivered between the conveyance arms 16. That is, in carrying in a LCD substrate into the processing room 2, the LCD substrate S is loaded and pushed up into the processing room 2 with the conveyance arm 16, a pin 12 is raised, and it thrusts up the LCD substrate S. And after evacuating the conveyance arm 16, it pushes up, a pin 12 is dropped and the LCD substrate S is laid on the lower electrode 6.

[0005] On the other hand, in taking out the LCD substrate S after processing, it performs actuation contrary to the above. That is, the LCD substrate S is delivered to a conveyance arm side by pushing up and raising a pin 12 by thrusting up the LCD substrate [finishing / processing] S, making the conveyance arm 16 invade under the LCD substrate S in this condition, pushing up, and dropping a pin 12. And the unload of the LCD substrate S is carried out by evacuating the conveyance arm 16.

[0006]

[Problem(s) to be Solved by the Invention] By the way, generally, polarization is produced according to the intermolecular force by contact, in contact between metals, contact of a metal and an insulator, and contact to a metal and a semi-conductor, when these exfoliate, a kind of decomposition reaction arises, and it is already known that electrification development, i.e., an exfoliation electrification phenomenon, will arise into the part which carries out depolarization completely and does not go out.

[0007] However, also in case the LCD substrate [finishing / the above-mentioned processing] S is pushed up and it thrusts up from the lower electrode 6 by the pin 12, exfoliation electrification will arise between the top face of the lower electrode 6, and the inferior surface of tongue of the LCD substrate S, and a charge will arise on the inferior surface of tongue of the LCD substrate S. Moreover, such an exfoliation electrification phenomenon was pushed up and was produced not only at the time of the pressure from below by the pin but at the time of delivery of the LCD substrate in the middle of conveyance. For this reason, there was a problem of the particle leading to the defect of a product adhering to the LCD substrate S, or making destruction of the component itself formed in the LCD substrate when there were many charges produce.

[0008] Moreover, on the property of a product, although high transparency was required, when the charge arose on the inferior surface of tongue of the LCD substrate S as mentioned above, residual gas and the reaction by-product after etching stuck to the substrate rear face, and membranes were formed, for example, and the LCD substrate had the trouble of spoiling the transparency of a substrate. The membrane formation on this rear face of a substrate cannot be removed at a subsequent washing process depending on a class, either, but fundamental solution is desired. Although exhausting residual gas completely after processing is also considered in order to lose the membrane formation development on this rear face of a substrate, it is not realistic from requiring much time amount by full exhaust air in this case, and producing the fall of a throughput. Such an exfoliation electrification phenomenon is a problem peculiar to a LCD substrate it is satisfactory to a semi-conductor wafer, in today when the LCD display was enlarged today and the LCD substrate also became large to about 30cmx40cm, it appears notably, and early stage solution is desired.

[0009] This invention is originated paying attention to the above troubles that this should be solved effectively. The purpose of this invention is to offer the processor which can miss the charge of the rear face of a processed object, and its operation.

[0010]

[Means for Solving the Problem] In order that this invention may solve the above-mentioned trouble In the processor which the plurality made possible by frequent appearance towards said installation side side from said installation base side pushes up at the time of carrying in and taking out of said processed object, and supported said processed object by the pin while having the installation base which lays the processed object which consists of a dielectric on an installation side It is after processing of said processed object, and before pushing up said processed object by said push raising pin, it has a switching means for touch-down for grounding said push raising pin.
[0011]
[Function] Since this invention was constituted as mentioned above, etching processing of the processed object which was laid on the installation side of an installation base and which consists of a dielectric will be carried out by the plasma etc. And in taking out a processed object [finishing / processing], after turning off the RF generator for for example, plasma generating, it grounds each push raising pin by closing the switching means for touch-down. Then, by pushing up and raising a pin, a processed object is pulled apart from an installation base and this is pushed up. Although a charge arises by exfoliation electrification development in the rear face of a processed object at the time of this pulling apart, this charge will be pushed up immediately, it will escape to a gland through a pin, and a processed object can prevent that it will be in an electrification condition for a long time.
[0012]
[Example] An example of the processor concerning this invention and its operation is explained to it, referring to an accompanying drawing to below. The sectional view showing an example of the processor which drawing 1 requires for this invention, and drawing 2 are enlarged drawings which are used with the equipment shown in drawing 1 and in which pushing up and showing the structure of a pin. In this example, it explains taking the case of a plasma etching system as a processor.
[0013] The plasma etching system 18 as a processor has the processing container 20 which consists of abbreviation rectangle-like the aluminum or stainless steel with which opening of the lower limit section was carried out, and this lower limit opening 12 is attached possible [sealing of the substrate 22 which consists of aluminum] so that it may illustrate. When using aluminum as a processing container 20, alumite processing is performed to the front face as corrosion resistance processing.
[0014] The inside of this processing container 20 is sealed as mentioned above, and is constituted as a processing room 24, and the up electrode 26 and the lower electrode 28 as an installation base which were made to counter the upper and lower sides of this processing room 24, and were made in parallel are arranged. It is set as about 80mm between these upper parts and the lower electrode 26, and 28.
[0015] Besides, installation base 28A which is a front face consists of aluminum by which alumite processing was carried out, and the section electrode 26 functions also as a supply header 30 of the raw gas with which the whole was made by the shape of a container. Therefore, the gas supply line 32 is connected to gas supply opening 30A of the supply header 30, and it is CF4 as raw gas in this gas supply line 32. And O2 It connects in common, respectively and the sources 34 and 36 of raw gas stored, respectively control a flow rate by the 1st and 2nd flow control valves 38 and 40 like a massflow controller, respectively. Moreover, all over the inferior surface of tongue of the up electrode 26, many blow-of-gas holes 42 which pass in the supply header 30 are formed, and raw gas is spouted towards the processing room 24.
[0016] The above-mentioned lower electrode 28 consists of tabular aluminum by which alumite processing was carried out by the thickness whose front face of installation side 28A is about 40 micrometers, and the LCD (Liquid Crystal Display) substrate S of 40cmx30cm magnitude will be laid in this front face as a processed object which consists of a dielectric. While this lower electrode 28 is fixed through the insulator 44 which consists of ceramics etc. on the above-mentioned substrate 22, the electric supply plate 46 is attached in the inferior surface of tongue of this lower electrode 28. The feeder 48 which it changed into the insulating condition connects with 13.56MHz RF generator 52 for plasma generating through the switch 50 for electric supply, and by impressing high-frequency voltage to the lower part [power source / this] electrode 28, this electric supply plate 46 is constituted so that the plasma may be stood between two electrodes.
[0017] The switching means 54 for touch-down by which it is characterized [of this invention] is

connected to juxtaposition to the above-mentioned switch 50 for electric supply, and by closing this switching means 54 if needed, it is constituted so that the lower electrode 28 can be made into the potential of a gland. Moreover, the whole inferior-surface-of-tongue abbreviation for the substrate 22 which consists of aluminum is covered, the RF shielding plate 56 is formed, and this, the flowing above-mentioned substrate 22, and the processing container 20 are grounded by grounding this shielding plate 56.

[0018] And the plurality for pushing up this pushes up at the time of the load unload of the above-mentioned LCD substrate S, and the pin 58 is formed in the lower part of the above-mentioned lower electrode 28 at it. this -- it pushes up, and the pin 58 is formed in four corners of the lower electrode 28, and supports four corners of a LCD substrate by four points. As shown also in drawing 2 , since [this] the pin 58 has the body 60 of a pin whose diameter which consists of conductors, such as aluminum, is about 5mm by pushing up and the tip of this body 60 of a pin contacts the rear face of the LCD substrate S, while being fabricated in the shape of the spherical surface, the base 62 whose diameter was expanded is established in the lower limit section.

[0019] This body 60 of a pin is constituted so that only the die length [move / and / to the pin insertion hole 62 formed in the above-mentioned lower electrode 28 by penetrating drawing Nakagami down / it / in the state of loosely fitting] which needs that tip can be projected more nearly up than the top face of the lower electrode 28. Therefore, rather than the body 60 of a pin, the cross-section configuration is made greatly slightly and the above-mentioned pin insertion hole 62 moves up and down by non-contact to the above-mentioned lower electrode 28 while the diameter of the lower part is expanded.

[0020] while the auxiliary rod 64 which becomes the base 62 of this body 60 of a pin from the conductor prolonged caudad is connected -- the lower limit section of this auxiliary rod 64 -- the insulators 66, such as Teflon, -- minding -- actuation of the air cylinder 14 (refer to drawing 1) for a vertical drive -- it connects with the pestle 68. this actuation -- it connects with each four push raising pins 58 in common, and a pestle 68 moves each pin 58 up and down to coincidence by one air cylinder 14 for a vertical drive.

[0021] Usually, the bellows 70 of the shape of bellows which consists of a metal in order to sever the free passage between these [these] since it will push up, the lower part of a pin 58 will be exposed to the ambient atmosphere of ordinary pressure, it will push up to this and the upper processing room 24 of a pin 58 will be in a vacua is used. That is, this bellows 70 is held possible [telescopic motion] in the bellows hold box 74 which consists of an approximate circle barrel-like metal airtightly connected to the lower limit section of the above-mentioned pin insertion hole 60 through the seal members 72, such as an O ring. In this bellows 70, the above-mentioned auxiliary rod 64 is opened for free passage, and while the upper limit of bellows 70 is airtightly connected to the base 62 of the above-mentioned body 60 of a pin, the lower limit of bellows 70 is airtightly attached through the metal auxiliary member 76 and metal O ring 78 at the pars basilaris ossis occipitalis of the bellows hold box 74. Moreover, the lower electrode 28 and the body 60 of a pin have flowed through the bellows hold box 74, the metallic auxiliary member 76, and bellows 70, and they are constituted so that it may become same electric potential electrically.

[0022] Therefore, it is constituted so that it pushes up, and it may push up, severing the free passage of the ordinary pressure ambient atmosphere of the lower part of a pin 58, and the inside of the processing room 24 and vertical movement of a pin 58 may be permitted according to an operation of this bellows 70. Moreover, the insertion hole 80 which inserts in the above-mentioned auxiliary rod 64 is formed in the pars basilaris ossis occipitalis of the above-mentioned bellows hold box 74, and the linear guide 82 for guaranteeing straight-line vertical motion of the above-mentioned auxiliary rod 64 is attached in this pars basilaris ossis occipitalis.

[0023] On the other hand, the focal ring 84 which centralizes the plasma on the LCD substrate S is formed in the periphery section of the above-mentioned lower electrode 28. Moreover, GETOBEN 86 opened and closed at the time of the load unload of the LCD substrate S and the exhaust pipe 88 connected to the vacuum pump which is not illustrated are connected to the side attachment wall of the processing container 20. And actuation of the above-mentioned air cylinder 14 for a vertical drive, the

switch 50 for electric supply, the switching means 54 for touch-down and the 1st and 2nd flow control valves 38, and 40 grades is controlled by the control section 90 which consists of a microcomputer.
[0024] Next, the operation of this invention is explained based on the above-mentioned example of equipment constituted as mentioned above. Drawing 3 is drawing showing the flow of the taking-out process after LCD substrate processing. First, GETOBEN 86 prepared in the flank of the processing container 20 is opened, the LCD substrate S supported by the conveyance arm 16 is carried in in the processing container 20, and this is located above the lower electrode 28. And by driving the air cylinder 14 for a vertical drive, each push raising pin 58 is raised, four corners of the LCD substrate S are thrust up at the tip, and delivery from the conveyance arm 16 is performed.
[0025] Next, after evacuating a conveyance arm, when it drops each push raising pin 58 and the body 60 of a pin is located below the front face of the lower electrode 28, the LCD substrate S will be laid in installation side 28A of the installation base 28 which is a lower electrode.
[0026] Next, by driving a vacuum pump, vacuum suction of the inside of the processing container 20 is carried out through an exhaust pipe 88, and the LCD substrate S is carried in into the processing container 20 from a load lock chamber. and raw gas 4 predetermined [the sources 34 and 36 of raw gas to], for example, CF, And O2 respectively -- 300SCCM(s) -- and it supplies 85 SCCMs at a time, and the inside of the processing container 20 is maintained, predetermined pressure, for example, 350mTorr extent. And by turning on the switch 50 for electric supply, high-frequency voltage is impressed to the lower electrode 28 from RF generator 52 for plasma generating, and the plasma is stood to the processing room 24 between the up electrode 26 and the lower electrode 28, for example, etching processing is performed. At this time, the power supplied from RF generator 52 is about 1500W.
[0027] Thus, if plasma-etching processing is completed, it will shift to the taking-out process of the LCD substrate shown in drawing 3 . At this process, since exfoliation electrification development arises in case the LCD substrate 28 is thrust up from the lower electrode 28, in order to control this effect as much as possible, it precedes pushing up and pushes up, and a pin 58 and the lower electrode 28 are grounded.
[0028] That is, first, after plasma treatment is completed in S1 in drawing 3 , the switch 50 for electric supply is turned off, impression of the high-frequency voltage to the lower electrode 28 is refused, and generating of the plasma is stopped. And only predetermined time amount continues vacuum suction and exhausts residual gas and the reaction by-product in the processing container 20 above to some extent.
[0029] Next, in S2, the switching means 54 for touch-down is turned on, and the lower electrode 28 is grounded through a feeder 48 and the electric supply plate 46. In this case, since it has flowed in the lower electrode 28 through the auxiliary member 76 and bellows 70 which pushed up and formed the body 60 of a pin made from the aluminum of a pin 58 in this metallic bellows hold box 74 and bottom circles side, the body 60 of a pin also serves as ground potential at the lower electrode 28 and coincidence. In addition, it insulates electrically the air cylinder 14 side with the insulator 66 formed in this lower limit, and an RF generator does not short-circuit the auxiliary rod 66 which it becomes this and same electric potential since this body 60 of a pin has flowed with the lower electrode 28 at the time of impression of high-frequency voltage, and plasma discharge does not arise among these, and is connected to the body 60 of a pin.
[0030] thus, the thing for which the air cylinder 14 for a vertical drive will be driven in S3 if it pushes up and the touch-down of a pin 58 and the lower electrode 28 is completed next -- actuation -- each push raising pin 58 is raised through a pestle 68, as shown in S4, four corners of the rear face of the LCD substrate S are contacted at the tip of the body 60 of a pin by this, and the whole LCD substrate S is pushed up. Although it faces that the LCD substrate S separates from the lower electrode 28 and a charge arises by exfoliation electrification development in the LCD substrate S at this time, it will push up, and will be immediately missed through a pin 58, and the generated charge becomes possible [the thing which is grounded and which control electrification of the LCD substrate S]. In this case, in pushing up and forming a pin 58 with aluminum, in order to secure conductivity with the LCD substrate S etc., it is made not to perform alumite processing to the contact section with the substrate at

the tip of a pin, and a contact part with pedestal material.
[0031] Moreover, since lower electrode 28 the very thing is also beforehand grounded in this case, the amount of the charge itself which the LCD substrate S pushes up and is sometimes produced at the rear face of the LCD substrate S can also be controlled, and electrification of the LCD substrate S can be controlled further. In addition, when the recess of the charge of the LCD substrate S is not fully performed in this case, push up and the number of pins 58 is made to increase, and it is made to distribute equally superficially and you may make it prepare this.
[0032] Thus, it can also be prevented that the component of a LCD substrate front face is destroyed with the charge of electrification, without particle adhering to this substrate itself by controlling electrification of the LCD substrate S. Furthermore, it can also be prevented that residual gas and the reaction by-product which are ionized adhere to a substrate rear face, and also form membranes from the LCD substrate S not being charged, and that can control and the transparency of a LCD substrate spoils.
[0033] Thus, if push raising of the LCD substrate S is completed, a conveyance arm will be made to invade under the LCD substrate S which opened GETOBEN 86 and was pushed up in S5, then, the air cylinder 14 for a vertical drive will be driven in S6, and each push raising pin 58 will be dropped. Then, it pushes up, and the LCD substrate S currently supported at the tip of a pin 58 is received and passed to a conveyance arm side. And the unload of the LCD substrate [finishing / processing] S will be carried out by evacuating a conveyance arm from the inside of the processing room 24 in S7. Henceforth, an unsettled LCD substrate will be loaded and processed similarly.
[0034] Thus, in this example, a LCD substrate [finishing / processing] can be pushed up, it can precede pushing up from the lower electrode 28 by the pin 58, this thing [that originate in an exfoliation electrification phenomenon and the rear face of a LCD substrate is charged since it pushes up and was made to ground a pin 58 and the lower electrode 28] can be prevented, and it can prevent that the various troubles accompanying electrification occur. Moreover, this kind of equipment can be carried out easily, without adding a large design change to the conventional processor only by establishing the switching means 54 for touch-down.
[0035] In addition, although an air cylinder 14 is driven and pushed up and the rise of a pin was started after having turned ON the switching means 54 for touch-down, pushing up with the lower electrode and grounding both the pins 58, if it was in the above-mentioned example, it is not limited to this, for example, pushes up, and the switching means for touch-down is prepared in a pin 58, it pushes up, and you may make it ground this in the middle of a rise of a pin.
[0036] Drawing 4 is drawing showing the configuration which operates as mentioned above. The switching means 54 for touch-down Metallic movable contact piece 54A which was pushed up and was prepared in the lower limit section of the metallic auxiliary rod 64 of a pin 58, Make it located in the small upper part of this movable contact piece 54A, and it is constituted by metallic fixed contact piece 54B attached and fixed to the above-mentioned RF shielding plate 56. If this auxiliary rod 64 goes up, the lower electrode 28 which the above-mentioned movable contact piece 54A and fixed contact piece 54B contact, and flows through the above-mentioned body 60 of a pin and this can be grounded. In this case, the distance L1 between movable contact piece 54A before actuation and fixed contact piece 54B is set up smaller than the distance L2 between the upper limit of the body 60 of a pin, and the top face of the lower electrode 28. When pushing up and raising a pin 58, first, movable contact piece 54A and fixed contact piece 54B contact, the body 60 of a pin is grounded and the tip of the body 60 of a pin contacts the rear face of the LCD substrate S after that. In addition, since it pushes up after contact of both the contact pieces 54A and 54B and a rise of a pin 58 is permitted, at least as for one side of both [these] the contact pieces 54A and 54B, flexibility has been given. Since it can carry out by a control section's 90 not performing the switching action of the switching means 54 for touch-down, only pushing up, and making it rise-and-fall actuation of a pin 58 interlocked with according to such a configuration, control becomes easy.
[0037] Moreover, after not being limited to this, but pushing up and a pin 58 and the LCD substrate S contacting, both the contact pieces 54A and 54B are contacted, and you may make it ground a pin 58 in this example, although it pushes up, and movable contact piece 54A and fixed contact piece 54B are

contacted in advance of contact to a pin 58 and the LCD substrate S, it pushes up and the pin 58 was grounded. In this case, although it is thought that the amount of the charge generated according to an exfoliation electrification phenomenon increases more slightly than a previous example, since the charge generated also in this case is grounded soon, is pushed up after this and escapes immediately through a pin 58, it can demonstrate a previous example and the same operation effectiveness as abbreviation.

[0038] Moreover, when so large that the charge generated in this example discharges, even if it is, since it will generate but [not when it pushes up and a pin 58 and the LCD substrate S contact] when both the contact pieces 54A and 54B contact, this discharge phenomenon does not give DAMEDO to the LCD substrate S.

[0039] Although the case where the RF generator for plasma generating was impressed to the lower electrode 28 was explained if it was in the above example, also when it is not limited to this but impresses the high-frequency voltage for plasma generating to the up electrode 26, of course, it can apply. In this case, it usually constitutes so that a lower electrode and the alumite coat which pushes up and is usually formed at the tip of the body 60 of a pin of a pin 58 in order to improve a flow with the rear face of a LCD substrate, since it pushes up and the pin 58 is always grounded may be removed.

[0040] Moreover, of course, all can be applied about the processed object which is not limited to a rectangle-like thing as a LCD substrate, for example, consists of dielectrics, such as the Xtal (quartz) wafer. Furthermore, this invention is not limited to a plasma etching system, but can be applied like other processors, such as an ion plating system and a CVD system.

[0041]

[Effect of the Invention] As explained above, according to the processor of this invention, and its operation, the operation effectiveness which was excellent as follows can be demonstrated. Since it preceded pushing up, and pushes up and was made to ground a pin and a lower electrode, the charge of a processed object produced on a processed object according to an exfoliation electrification phenomenon can be missed immediately. Therefore, it can abolish it not only can preventing destruction of a component beforehand with the adhesion and the charge of particle leading to the defect of a product, but also preventing adhesion of residual gas or a reaction by-product, and spoiling transparency.

TECHNICAL FIELD

[Industrial Application] This invention relates to the processor which performs plasma etching and membrane formation processing to a glass substrate etc., and its operation.

PRIOR ART

[Description of the Prior Art] In order to perform plasma-etching processing and membrane formation processing to front faces, such as a LCD substrate which consists of a semi-conductor wafer or glass, generally, various kinds of processors are known. Here, taking the case of plasma treatment equipment, it explains as equipment for performing plasma treatment to the LCD substrate front face which consists of glass which is a dielectric.

[0003] Drawing 5 shows the outline block diagram of the conventional plasma treatment equipment for LCD substrates, rectangle-like the up electrode 4 and the lower electrode 6 counter in parallel in the processing room 2, this kind of processor is arranged, and the LCD substrate S of the shape for example, of a rectangle is laid on the susceptor as a lower electrode 6. And if it is in either the above-mentioned up electrode 4 or the lower electrode 6 and the example of illustration, RF generator 10 for plasma generating is connected to the lower electrode 6 through the open/close switch 8 for plasma impression, and the plasma will be generated among two poles with the high-frequency voltage from this power source.

[0004] Moreover, four corners of the lower electrode 6 are made to penetrate this, plurality pushes up, the pin 12 is formed in the vertical direction possible [frequent appearance], and each pin 12 moves up and down in common by the air cylinder 14 for a vertical drive. therefore -- this -- it pushes up, and you move a pin 12 up and down, make it go up and down the LCD substrate S, and the LCD substrate S is delivered between the conveyance arms 16. That is, in carrying in a LCD substrate into the processing room 2, the LCD substrate S is loaded and pushed up into the processing room 2 with the conveyance arm 16, a pin 12 is raised, and it thrusts up the LCD substrate S. And after evacuating the conveyance arm 16, it pushes up, a pin 12 is dropped and the LCD substrate S is laid on the lower electrode 6.

[0005] On the other hand, in taking out the LCD substrate S after processing, it performs actuation contrary to the above. That is, the LCD substrate S is delivered to a conveyance arm side by pushing up and raising a pin 12 by thrusting up the LCD substrate [finishing / processing] S, making the conveyance arm 16 invade under the LCD substrate S in this condition, pushing up, and dropping a pin 12. And the unload of the LCD substrate S is carried out by evacuating the conveyance arm 16.

EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, according to the processor of this invention, and its operation, the operation effectiveness which was excellent as follows can be demonstrated. Since it preceded pushing up, and pushes up and was made to ground a pin and a lower electrode, the charge of a processed object produced on a processed object according to an exfoliation electrification phenomenon can be missed immediately. Therefore, it can abolish it not only can preventing destruction of a component beforehand with the adhesion and the charge of particle leading to the defect of a product, but also preventing adhesion of residual gas or a reaction by-product, and spoiling transparency.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] By the way, generally, polarization is produced according to the intermolecular force by contact, in contact between metals, contact of a metal and an insulator, and contact to a metal and a semi-conductor, when these exfoliate, a kind of decomposition reaction arises, and it is already known that electrification development, i.e., an exfoliation electrification phenomenon, will arise into the part which carries out depolarization completely and does not go out.

[0007] However, also in case the LCD substrate [finishing / the above-mentioned processing] S is pushed up and it thrusts up from the lower electrode 6 by the pin 12, exfoliation electrification will arise between the top face of the lower electrode 6, and the inferior surface of tongue of the LCD substrate S, and a charge will arise on the inferior surface of tongue of the LCD substrate S. Moreover, such an exfoliation electrification phenomenon was pushed up and was produced not only at the time of the pressure from below by the pin but at the time of delivery of the LCD substrate in the middle of conveyance. For this reason, there was a problem of the particle leading to the defect of a product adhering to the LCD substrate S, or making destruction of the component itself formed in the LCD substrate when there were many charges produce.

[0008] Moreover, on the property of a product, although high transparency was required, when the charge arose on the inferior surface of tongue of the LCD substrate S as mentioned above, residual gas and the reaction by-product after etching stuck to the substrate rear face, and membranes were formed, for example, and the LCD substrate had the trouble of spoiling the transparency of a substrate. The membrane formation on this rear face of a substrate cannot be removed at a subsequent washing process depending on a class, either, but fundamental solution is desired. Although exhausting residual gas completely after processing is also considered in order to lose the membrane formation development on this rear face of a substrate, it is not realistic from requiring much time amount by full

exhaust air in this case, and producing the fall of a throughput. Such an exfoliation electrification phenomenon is a problem peculiar to a LCD substrate it is satisfactory to a semi-conductor wafer, in today when the LCD display was enlarged today and the LCD substrate also became large to about 30cmx40cm, it appears notably, and early stage solution is desired.
[0009] This invention is originated paying attention to the above troubles that this should be solved effectively. The purpose of this invention is to offer the processor which can miss the charge of the rear face of a processed object, and its operation.

MEANS

[Means for Solving the Problem] In order that this invention may solve the above-mentioned trouble In the processor which the plurality made possible by frequent appearance towards said installation side side from said installation base side pushes up at the time of carrying in and taking out of said processed object, and supported said processed object by the pin while having the installation base which lays the processed object which consists of a dielectric on an installation side It is after processing of said processed object, and before pushing up said processed object by said push raising pin, it has a switching means for touch-down for grounding said push raising pin.

OPERATION

[Function] Since this invention was constituted as mentioned above, etching processing of the processed object which was laid on the installation side of an installation base and which consists of a dielectric will be carried out by the plasma etc. And in taking out a processed object [finishing / processing], after turning off the RF generator for for example, plasma generating, it grounds each push raising pin by closing the switching means for touch-down. Then, by pushing up and raising a pin, a processed object is pulled apart from an installation base and this is pushed up. Although a charge arises by exfoliation electrification development in the rear face of a processed object at the time of this pulling apart, this charge will be pushed up immediately, it will escape to a gland through a pin, and a processed object can prevent that it will be in an electrification condition for a long time.

EXAMPLE

[Example] An example of the processor concerning this invention and its operation is explained to it, referring to an accompanying drawing to below. The sectional view showing an example of the processor which drawing 1 requires for this invention, and drawing 2 are enlarged drawings which are used with the equipment shown in drawing 1 and in which pushing up and showing the structure of a pin. In this example, it explains taking the case of a plasma etching system as a processor.
[0013] The plasma etching system 18 as a processor has the processing container 20 which consists of abbreviation rectangle-like the aluminum or stainless steel with which opening of the lower limit section was carried out, and this lower limit opening 12 is attached possible [sealing of the substrate 22 which consists of aluminum] so that it may illustrate. When using aluminum as a processing container 20, alumite processing is performed to the front face as corrosion resistance processing.
[0014] The inside of this processing container 20 is sealed as mentioned above, and is constituted as a processing room 24, and the up electrode 26 and the lower electrode 28 as an installation base which were made to counter the upper and lower sides of this processing room 24, and were made in parallel are arranged. It is set as about 80mm between these upper parts and the lower electrode 26, and 28.
[0015] Besides, installation base 28A which is a front face consists of aluminum by which alumite processing was carried out, and the section electrode 26 functions also as a supply header 30 of the raw gas with which the whole was made by the shape of a container. Therefore, the gas supply line 32

is connected to gas supply opening 30A of the supply header 30, and it is CF4 as raw gas in this gas supply line 32. And O2 It connects in common, respectively and the sources 34 and 36 of raw gas stored, respectively control a flow rate by the 1st and 2nd flow control valves 38 and 40 like a massflow controller, respectively. Moreover, all over the inferior surface of tongue of the up electrode 26, many blow-of-gas holes 42 which pass in the supply header 30 are formed, and raw gas is spouted towards the processing room 24.

[0016] The above-mentioned lower electrode 28 consists of tabular aluminum by which alumite processing was carried out by the thickness whose front face of installation side 28A is about 40 micrometers, and the LCD (Liquid Crystal Display) substrate S of 40cmx30cm magnitude will be laid in this front face as a processed object which consists of a dielectric. While this lower electrode 28 is fixed through the insulator 44 which consists of ceramics etc. on the above-mentioned substrate 22, the electric supply plate 46 is attached in the inferior surface of tongue of this lower electrode 28. The feeder 48 which it changed into the insulating condition connects with 13.56MHz RF generator 52 for plasma generating through the switch 50 for electric supply, and by impressing high-frequency voltage to the lower part [power source / this] electrode 28, this electric supply plate 46 is constituted so that the plasma may be stood between two electrodes.

[0017] The switching means 54 for touch-down by which it is characterized [of this invention] is connected to juxtaposition to the above-mentioned switch 50 for electric supply, and by closing this switching means 54 if needed, it is constituted so that the lower electrode 28 can be made into the potential of a gland. Moreover, the whole inferior-surface-of-tongue abbreviation for the substrate 22 which consists of aluminum is covered, the RF shielding plate 56 is formed, and this, the flowing above-mentioned substrate 22, and the processing container 20 are grounded by grounding this shielding plate 56.

[0018] And the plurality for pushing up this pushes up at the time of the load unload of the above-mentioned LCD substrate S, and the pin 58 is formed in the lower part of the above-mentioned lower electrode 28 at it. this -- it pushes up, and the pin 58 is formed in four corners of the lower electrode 28, and supports four corners of a LCD substrate by four points. As shown also in drawing 2 , since [this] the pin 58 has the body 60 of a pin whose diameter which consists of conductors, such as aluminum, is about 5mm by pushing up and the tip of this body 60 of a pin contacts the rear face of the LCD substrate S, while being fabricated in the shape of the spherical surface, the base 62 whose diameter was expanded is established in the lower limit section.

[0019] This body 60 of a pin is constituted so that only the die length [move / and / to the pin insertion hole 62 formed in the above-mentioned lower electrode 28 by penetrating drawing Nakagami down / it / in the state of loosely fitting] which needs that tip can be projected more nearly up than the top face of the lower electrode 28. Therefore, rather than the body 60 of a pin, the cross-section configuration is made greatly slightly and the above-mentioned pin insertion hole 62 moves up and down by non-contact to the above-mentioned lower electrode 28 while the diameter of the lower part is expanded.

[0020] while the auxiliary rod 64 which becomes the base 62 of this body 60 of a pin from the conductor prolonged caudad is connected -- the lower limit section of this auxiliary rod 64 -- the insulators 66, such as Teflon, -- minding -- actuation of the air cylinder 14 (refer to drawing 1) for a vertical drive -- it connects with the pestle 68. this actuation -- it connects with each four push raising pins 58 in common, and a pestle 68 moves each pin 58 up and down to coincidence by one air cylinder 14 for a vertical drive.

[0021] Usually, the bellows 70 of the shape of bellows which consists of a metal in order to sever the free passage between these [these] since it will push up, the lower part of a pin 58 will be exposed to the ambient atmosphere of ordinary pressure, it will push up to this and the upper processing room 24 of a pin 58 will be in a vacua is used. That is, this bellows 70 is held possible [telescopic motion] in the bellows hold box 74 which consists of an approximate circle barrel-like metal airtightly connected to the lower limit section of the above-mentioned pin insertion hole 60 through the seal members 72, such as an O ring. In this bellows 70, the above-mentioned auxiliary rod 64 is opened for free passage, and while the upper limit of bellows 70 is airtightly connected to the base 62 of the above-mentioned

body 60 of a pin, the lower limit of bellows 70 is airtightly attached through the metal auxiliary member 76 and metal O ring 78 at the pars basilaris ossis occipitalis of the bellows hold box 74. Moreover, the lower electrode 28 and the body 60 of a pin have flowed through the bellows hold box 74, the metallic auxiliary member 76, and bellows 70, and they are constituted so that it may become same electric potential electrically.

[0022] Therefore, it is constituted so that it pushes up, and it may push up, severing the free passage of the ordinary pressure ambient atmosphere of the lower part of a pin 58, and the inside of the processing room 24 and vertical movement of a pin 58 may be permitted according to an operation of this bellows 70. Moreover, the insertion hole 80 which inserts in the above-mentioned auxiliary rod 64 is formed in the pars basilaris ossis occipitalis of the above-mentioned bellows hold box 74, and the linear guide 82 for guaranteeing straight-line vertical motion of the above-mentioned auxiliary rod 64 is attached in this pars basilaris ossis occipitalis.

[0023] On the other hand, the focal ring 84 which centralizes the plasma on the LCD substrate S is formed in the periphery section of the above-mentioned lower electrode 28. Moreover, GETOBEN 86 opened and closed at the time of the load unload of the LCD substrate S and the exhaust pipe 88 connected to the vacuum pump which is not illustrated are connected to the side attachment wall of the processing container 20. And actuation of the above-mentioned air cylinder 14 for a vertical drive, the switch 50 for electric supply, the switching means 54 for touch-down and the 1st and 2nd flow control valves 38, and 40 grades is controlled by the control section 90 which consists of a microcomputer.

[0024] Next, the operation of this invention is explained based on the above-mentioned example of equipment constituted as mentioned above. Drawing 3 is drawing showing the flow of the taking-out process after LCD substrate processing. First, GETOBEN 86 prepared in the flank of the processing container 20 is opened, the LCD substrate S supported by the conveyance arm 16 is carried in in the processing container 20, and this is located above the lower electrode 28. And by driving the air cylinder 14 for a vertical drive, each push raising pin 58 is raised, four corners of the LCD substrate S are thrust up at the tip, and delivery from the conveyance arm 16 is performed.

[0025] Next, after evacuating a conveyance arm, when it drops each push raising pin 58 and the body 60 of a pin is located below the front face of the lower electrode 28, the LCD substrate S will be laid in installation side 28A of the installation base 28 which is a lower electrode.

[0026] Next, by driving a vacuum pump, vacuum suction of the inside of the processing container 20 is carried out through an exhaust pipe 88, and the LCD substrate S is carried in into the processing container 20 from a load lock chamber. and raw gas 4 predetermined [the sources 34 and 36 of raw gas to], for example, CF, And O2 respectively -- 300SCCM(s) -- and it supplies 85 SCCMs at a time, and the inside of the processing container 20 is maintained, predetermined pressure, for example, 350mTorr extent. And by turning on the switch 50 for electric supply, high-frequency voltage is impressed to the lower electrode 28 from RF generator 52 for plasma generating, and the plasma is stood to the processing room 24 between the up electrode 26 and the lower electrode 28, for example, etching processing is performed. At this time, the power supplied from RF generator 52 is about 1500W.

[0027] Thus, if plasma-etching processing is completed, it will shift to the taking-out process of the LCD substrate shown in drawing 3 . At this process, since exfoliation electrification development arises in case the LCD substrate 28 is thrust up from the lower electrode 28, in order to control this effect as much as possible, it precedes pushing up and pushes up, and a pin 58 and the lower electrode 28 are grounded.

[0028] That is, first, after plasma treatment is completed in S1 in drawing 3 , the switch 50 for electric supply is turned off, impression of the high-frequency voltage to the lower electrode 28 is refused, and generating of the plasma is stopped. And only predetermined time amount continues vacuum suction and exhausts residual gas and the reaction by-product in the processing container 20 above to some extent.

[0029] Next, in S2, the switching means 54 for touch-down is turned on, and the lower electrode 28 is grounded through a feeder 48 and the electric supply plate 46. In this case, since it has flowed in the lower electrode 28 through the auxiliary member 76 and bellows 70 which pushed up and formed the

body 60 of a pin made from the aluminum of a pin 58 in this metallic bellows hold box 74 and bottom circles side, the body 60 of a pin also serves as ground potential at the lower electrode 28 and coincidence. In addition, it insulates electrically the air cylinder 14 side with the insulator 66 formed in this lower limit, and an RF generator does not short-circuit the auxiliary rod 66 which it becomes this and same electric potential since this body 60 of a pin has flowed with the lower electrode 28 at the time of impression of high-frequency voltage, and plasma discharge does not arise among these, and is connected to the body 60 of a pin.

[0030] thus, the thing for which the air cylinder 14 for a vertical drive will be driven in S3 if it pushes up and the touch-down of a pin 58 and the lower electrode 28 is completed next -- actuation -- each push raising pin 58 is raised through a pestle 68, as shown in S4, four corners of the rear face of the LCD substrate S are contacted at the tip of the body 60 of a pin by this, and the whole LCD substrate S is pushed up. Although it faces that the LCD substrate S separates from the lower electrode 28 and a charge arises by exfoliation electrification development in the LCD substrate S at this time, it will push up, and will be immediately missed through a pin 58, and the generated charge becomes possible [the thing which is grounded and which control electrification of the LCD substrate S]. In this case, in pushing up and forming a pin 58 with aluminum, in order to secure conductivity with the LCD substrate S etc., it is made not to perform alumite processing to the contact section with the substrate at the tip of a pin, and a contact part with pedestal material.

[0031] Moreover, since lower electrode 28 the very thing is also beforehand grounded in this case, the amount of the charge itself which the LCD substrate S pushes up and is sometimes produced at the rear face of the LCD substrate S can also be controlled, and electrification of the LCD substrate S can be controlled further. In addition, when the recess of the charge of the LCD substrate S is not fully performed in this case, push up and the number of pins 58 is made to increase, and it is made to distribute equally superficially and you may make it prepare this.

[0032] Thus, it can also be prevented that the component of a LCD substrate front face is destroyed with the charge of electrification, without particle adhering to this substrate itself by controlling electrification of the LCD substrate S. Furthermore, it can also be prevented that residual gas and the reaction by-product which are ionized adhere to a substrate rear face, and also form membranes from the LCD substrate S not being charged, and that can control and the transparency of a LCD substrate spoils.

[0033] Thus, if push raising of the LCD substrate S is completed, a conveyance arm will be made to invade under the LCD substrate S which opened GETOBEN 86 and was pushed up in S5, then, the air cylinder 14 for a vertical drive will be driven in S6, and each push raising pin 58 will be dropped. Then, it pushes up, and the LCD substrate S currently supported at the tip of a pin 58 is received and passed to a conveyance arm side. And the unload of the LCD substrate [finishing / processing] S will be carried out by evacuating a conveyance arm from the inside of the processing room 24 in S7. Henceforth, an unsettled LCD substrate will be loaded and processed similarly.

[0034] Thus, in this example, a LCD substrate [finishing / processing] can be pushed up, it can precede pushing up from the lower electrode 28 by the pin 58, this thing [that originate in an exfoliation electrification phenomenon and the rear face of a LCD substrate is charged since it pushes up and was made to ground a pin 58 and the lower electrode 28] can be prevented, and it can prevent that the various troubles accompanying electrification occur. Moreover, this kind of equipment can be carried out easily, without adding a large design change to the conventional processor only by establishing the switching means 54 for touch-down.

[0035] In addition, although an air cylinder 14 is driven and pushed up and the rise of a pin was started after having turned ON the switching means 54 for touch-down, pushing up with the lower electrode and grounding both the pins 58, if it was in the above-mentioned example, it is not limited to this, for example, pushes up, and the switching means for touch-down is prepared in a pin 58, it pushes up, and you may make it ground this in the middle of a rise of a pin.

[0036] Drawing 4 is drawing showing the configuration which operates as mentioned above. The switching means 54 for touch-down Metallic movable contact piece 54A which was pushed up and was prepared in the lower limit section of the metallic auxiliary rod 64 of a pin 58, Make it located in

the small upper part of this movable contact piece 54A, and it is constituted by metallic fixed contact piece 54B attached and fixed to the above-mentioned RF shielding plate 56. If this auxiliary rod 64 goes up, the lower electrode 28 which the above-mentioned movable contact piece 54A and fixed contact piece 54B contact, and flows through the above-mentioned body 60 of a pin and this can be grounded. In this case, the distance L1 between movable contact piece 54A before actuation and fixed contact piece 54B is set up smaller than the distance L2 between the upper limit of the body 60 of a pin, and the top face of the lower electrode 28. When pushing up and raising a pin 58, first, movable contact piece 54A and fixed contact piece 54B contact, the body 60 of a pin is grounded and the tip of the body 60 of a pin contacts the rear face of the LCD substrate S after that. In addition, since it pushes up after contact of both the contact pieces 54A and 54B and a rise of a pin 58 is permitted, at least as for one side of both [these] the contact pieces 54A and 54B, flexibility has been given. Since it can carry out by a control section's 90 not performing the switching action of the switching means 54 for touch-down, only pushing up, and making it rise-and-fall actuation of a pin 58 interlocked with according to such a configuration, control becomes easy.

[0037] Moreover, after not being limited to this, but pushing up and a pin 58 and the LCD substrate S contacting, both the contact pieces 54A and 54B are contacted, and you may make it ground a pin 58 in this example, although it pushes up, and movable contact piece 54A and fixed contact piece 54B are contacted in advance of contact to a pin 58 and the LCD substrate S, it pushes up and the pin 58 was grounded. In this case, although it is thought that the amount of the charge generated according to an exfoliation electrification phenomenon increases more slightly than a previous example, since the charge generated also in this case is grounded soon, is pushed up after this and escapes immediately through a pin 58, it can demonstrate a previous example and the same operation effectiveness as abbreviation.

[0038] Moreover, when so large that the charge generated in this example discharges, even if it is, since it will generate but [not when it pushes up and a pin 58 and the LCD substrate S contact] when both the contact pieces 54A and 54B contact, this discharge phenomenon does not give DAMEDO to the LCD substrate S.

[0039] Although the case where the RF generator for plasma generating was impressed to the lower electrode 28 was explained if it was in the above example, also when it is not limited to this but impresses the high-frequency voltage for plasma generating to the up electrode 26, of course, it can apply. In this case, it usually constitutes so that a lower electrode and the alumite coat which pushes up and is usually formed at the tip of the body 60 of a pin of a pin 58 in order to improve a flow with the rear face of a LCD substrate, since it pushes up and the pin 58 is always grounded may be removed.

[0040] Moreover, of course, all can be applied about the processed object which is not limited to a rectangle-like thing as a LCD substrate, for example, consists of dielectrics, such as the Xtal (quartz) wafer. Furthermore, this invention is not limited to a plasma etching system, but can be applied like other processors, such as an ion plating system and a CVD system.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the sectional view showing an example of the processor concerning this invention.

[Drawing 2] It is the enlarged drawing which is used in the processor shown in drawing 1 and in which pushing up and showing the structure of a pin.

[Drawing 3] It is drawing showing the flow of the taking-out process of a processed object.

[Drawing 4] It is the enlarged drawing which established the switching means for touch-down and in which pushing up and showing the structure of a pin.

[Drawing 5] It is the outline block diagram showing the conventional processor.

[Description of Notations]

14 Air Cylinder for Vertical Drive

16 Conveyance Arm

18 Plasma Etching System (Processor)
20 Processing Container
24 Processing Room
26 Up Electrode
28 Lower Electrode (Installation Base)
28A Installation side
50 Switch for Electric Supply
52 RF Generator
54 Switching Means for Touch-down
58 Push Up and it is Pin.
60 Body of Pin
64 Auxiliary Rod
66 Insulator
70 Bellows
74 Bellows Hold Box
76 Metallic Auxiliary Member
82 Linear Guide
S LCD substrate (processed object which consists of a dielectric)

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（A）**　(11)特許出願公開番号

特開平7－74231

(43)公開日　平成７年(1995)３月17日

(51)Int.Cl.[6]	識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ｈ０１Ｌ　21/68	Ｎ			
Ｃ０３Ｃ　15/00	Ａ			
Ｃ３０Ｂ　33/00		8216－4G		
Ｈ０１Ｌ　21/3065				
			Ｈ０１Ｌ　21/ 302	Ｃ

審査請求　未請求　請求項の数５　ＦＤ　（全８頁）

(21)出願番号　特願平5－239129

(22)出願日　平成５年(1993)８月31日

(71)出願人　000219967
東京エレクトロン株式会社
東京都港区赤坂５丁目３番６号

(71)出願人　000109565
東京エレクトロン山梨株式会社
山梨県韮崎市藤井町北下条2381番地の１

(72)発明者　友吉　力
山梨県韮崎市藤井町北下条2381番地の１
東京エレクトロン山梨株式会社内

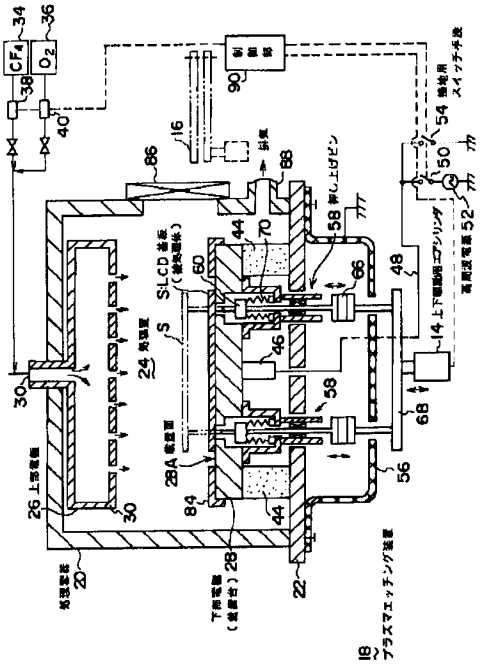
(74)代理人　弁理士　浅井　章弘　（外１名）

(54)【発明の名称】　処理装置及びその使用方法

(57)【要約】

【目的】　被処理体の裏面の電荷を逃すことができる処理装置及びその使用方法を提供する。

【構成】　誘電体よりなる被処理体Ｓを載置面２８Ａ上に載置する載置台２８を有し、この被処理体Ｓをこの搬入・搬出時に押し上げる複数の押し上げピン５８を有する処理装置１８において、上記押し上げピン及び載置台を接地させるための接地用スイッチ手段５４を設ける。そして、被処理体の例えばプラズマエッチングによる処理後、上記スイッチ手段をオンにして押し上げピンと載置台を接地し、その後、押し上げピンを上昇させてこれにより被処理体を突き上げる。これにより、剥離帯電現象によって被処理体に生じた電荷は直ちにピンを介して逃げることになる。



1

【特許請求の範囲】

【請求項１】　誘電体よりなる被処理体を載置面上に載置する載置台を有すると共に前記被処理体の搬入・搬出時には前記載置台側より前記載置面側に向けて出没可能になされた複数の押し上げピンにより前記被処理体を支持するようにした処理装置において、前記被処理体の処理後であって前記被処理体を前記押し上げピンにより押し上げる前に、前記押し上げピンを接地させるための接地用スイッチ手段を備えるように構成したことを特徴とする処理装置。

【請求項２】　前記載置台には、プラズマ発生用の高周波電源がオン・オフ可能に接続されていることを特徴とする請求項１記載の処理装置。

【請求項３】　前記接地用スイッチ手段は、前記押し上げピンに設けられており、前記押し上げピンが上昇してこの先端が前記被処理体と接触する前に前記接地用スイッチ手段がオンするように構成したことを特徴とする請求項１または２記載の処理装置。

【請求項４】　処理室内の載置台の載置面上に載置した誘電体よりなる被処理体に所定の処理を施して、前記載置台を貫通する複数の押し上げピンにより押し上げて搬出するようになした処理装置の使用方法において、前記押し上げピンを接地させるための接地用スイッチ手段を設け、前記押し上げピンが前記被処理体と接触する前に前記接地用スイッチ手段をオンにして前記押し上げピンを接地するように構成したことを特徴とする処理装置の使用方法。

【請求項５】　前記処理はプラズマ処理であり、前記押し上げピンの接地に先立ってプラズマ発生用の高周波電圧の印加を停止するように構成したことを特徴とする請求項４記載の処理装置の使用方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、ガラス基板等にプラズマエッチングや成膜処理を施す処理装置及びその使用方法に関する。

【０００２】

【従来の技術】一般に、半導体ウエハやガラスよりなるＬＣＤ基板等の表面にプラズマエッチング処理や成膜処理を施すためには各種の処理装置が知られている。ここで、誘電体であるガラスよりなるＬＣＤ基板表面に対してプラズマ処理を施すための装置としてプラズマ処理装置を例にとって説明する。

【０００３】図５はＬＣＤ基板用の従来のプラズマ処理装置の概略構成図を示し、この種の処理装置は処理室２内に例えば矩形状の上部電極４と下部電極６とが平行に対向して配置されており、下部電極６としてのサセプタ上に例えば矩形状のＬＣＤ基板Ｓが載置される。そして、上記上部電極４或いは下部電極６のいずれか一方、図示例にあっては下部電極６にプラズマ印加用の開閉スイッチ８を介してプラズマ発生用の高周波電源１０が接続されており、この電源からの高周波電圧により両極間にプラズマを発生することになる。

2

【０００４】また、下部電極６の４隅にはこれを貫通させて複数の押し上げピン１２が上下方向へ出没可能に設けられており、各ピン１２は上下駆動用エアシリンダ１４により共通に上下動される。従って、この押し上げピン１２を上下動させてＬＣＤ基板Ｓを昇降させて搬送アーム１６との間でＬＣＤ基板Ｓの受け渡しを行うようになっている。すなわち、ＬＣＤ基板を処理室２内へ搬入する場合にはＬＣＤ基板Ｓを搬送アーム１６で処理室２内へロードし、押し上げピン１２を上昇させてＬＣＤ基板Ｓを突き上げる。そして、搬送アーム１６を退避させた後に、押し上げピン１２を降下させてＬＣＤ基板Ｓを下部電極６上に載置する。

【０００５】一方、処理後のＬＣＤ基板Ｓを搬出する場合には、上記と逆の操作を行う。すなわち、押し上げピン１２を上昇させることにより処理済みのＬＣＤ基板Ｓを突き上げ、この状態で搬送アーム１６をＬＣＤ基板Ｓの下方に侵入させ、押し上げピン１２を降下させることにより、ＬＣＤ基板Ｓを搬送アーム側に受け渡す。そして、搬送アーム１６を退避させることによりＬＣＤ基板Ｓをアンロードする。

【０００６】

【発明が解決しようとする課題】ところで、一般に金属相互の接触、金属と絶縁体の接触、金属と半導体との接触の場合には、接触による分子間力により成極を生じ、これらが剥離する場合には一種の分解反応が生じ、完全に脱成極し切れない部分に帯電現像、すなわち剥離帯電現象が生ずることがすでに知られている。

【０００７】しかるに、上記処理済みのＬＣＤ基板Ｓを押し上げピン１２により下部電極６から突き上げる際にも下部電極６の上面とＬＣＤ基板Ｓの下面との間で剥離帯電が生じ、ＬＣＤ基板Ｓの下面に電荷が生じてしまう。また、このような剥離帯電現象は、押し上げピンによる突き上げ時のみならず、搬送途中のＬＣＤ基板の受け渡し時にも生じていた。このために、ＬＣＤ基板Ｓに製品の欠陥の原因となるパーティクルが付着したり、或いは電荷が多い場合にはＬＣＤ基板に形成した素子自体の破壊を生ぜしめるという問題があった。

【０００８】また、ＬＣＤ基板は、製品の特性上、高い透明度が要求されるが、上述のようにＬＣＤ基板Ｓの下面に電荷が生ずると、例えばエッチング後の残留ガスや反応副生成物が基板裏面に吸着して成膜し、基板の透明度を損なってしまうという問題点があった。この基板裏面の成膜は、種類によってはその後の洗浄工程でも除去することができず、根本的な解決が望まれている。この基板裏面の成膜現像をなくすために、処理後に残留ガスを完全に排気することも考えられるが、この場合には完全排気までに多くの時間を要し、スループットの低下を

3

生ずることから現実的ではない。このような剥離帯電現象は、半導体ウエハにはないＬＣＤ基板特有の問題であり、ＬＣＤ表示装置が大型化してＬＣＤ基板も例えば３０ｃｍ×４０ｃｍ程度まで大きくなった今日においては顕著に表れ、早期な解決が望まれている。

【０００９】本発明は、以上のような問題点に着目し、これを有効に解決すべく創案されたものである。本発明の目的は、被処理体の裏面の電荷を逃すことができる処理装置及びその使用方法を提供することにある。

【００１０】

【課題を解決するための手段】本発明は、上記問題点を解決するために、誘電体よりなる被処理体を載置面上に載置する載置台を有すると共に前記被処理体の搬入・搬出時には前記載置台側より前記載置面側に向けて出没可能になされた複数の押し上げピンにより前記被処理体を支持するようにした処理装置において、前記被処理体の処理後であって前記被処理体を前記押し上げピンにより押し上げる前に、前記押し上げピンを接地させるための接地用スイッチ手段を備えるようにしたものである。

【００１１】

【作用】本発明は、以上のように構成したので、載置台の載置面上に載置された、誘電体よりなる被処理体は例えばプラズマ等によりエッチング処理されることになる。そして、処理済みの被処理体を搬出する場合には、例えばプラズマ発生用の高周波電源をオフした後に、接地用スイッチ手段を閉じることにより各押し上げピンを接地させる。その後、押し上げピンを上昇させることにより被処理体を載置台から引き離しこれを押し上げる。この引き離し時に、被処理体の裏面には剥離帯電現像によって電荷が生ずるが、この電荷は直ちに押し上げピンを介してグランドに逃げてしまうことになり、被処理体が長時間、帯電状態になることを阻止することができる。

【００１２】

【実施例】以下に、本発明に係る処理装置及びその使用方法の一例を添付図面を参照しつつ説明する。図１は本発明に係る処理装置の一例を示す断面図、図２は図１に示す装置にて用いる押し上げピンの構造を示す拡大図である。本実施例においては処理装置としてプラズマエッチング装置を例にとって説明する。

【００１３】図示するように処理装置としてのプラズマエッチング装置１８は、下端部が開口された略方形状のアルミニウム或いはステンレスよりなる処理容器２０を有しており、この下端開口部１２は例えばアルミニウムよりなる基板２２が密閉可能に取り付けられている。処理容器２０としてアルミニウムを用いる場合には、耐腐食性処理としてその表面にはアルマイト処理が施される。

【００１４】この処理容器２０内は上述のように密閉されて処理室２４として構成され、この処理室２４の上下

4

には対向させて平行になされた上部電極２６と載置台としての下部電極２８が配置されている。これら上部及び下部電極２６、２８間は例えば８０mm程度に設定されている。

【００１５】この上部電極２６は、表面である載置台２８Ａがアルマイト処理されたアルミニウムよりなり、全体が容器状になされた処理ガスの供給ヘッダ３０としても機能する。そのために、供給ヘッダ３０のガス供給口３０Ａにはガス供給管３２が接続されており、このガス供給管３２には、処理ガスとして例えばCF_4及びO_2をそれぞれ貯留する処理ガス源３４及び３６がそれぞれ共通に接続されており、それぞれマスフローコントローラの如き第１及び第２の流量制御弁３８、４０により流量を制御するようになっている。また、上部電極２６の下面全面には、供給ヘッダ３０内に通ずる多数のガス噴出孔４２が形成されており、処理室２４に向けて処理ガスを噴出するようになっている。

【００１６】上記下部電極２８は、載置面２８Ａの表面が例えば４０μm程度の厚みでアルマイト処理された板状のアルミニウムよりなり、この表面に、誘電体よりなる被処理体として例えば４０ｃｍ×３０ｃｍの大きさのＬＣＤ（Ｌｉｑｕｉｄ　Ｃｒｙｓｔａｌ　Ｄｉｓｐｌａｙ）基板Ｓが載置されることになる。この下部電極２８は、上記基板２２上に例えばセラミックス等よりなる絶縁体４４を介して固定されると共に、この下部電極２８の下面には給電板４６が取り付けられる。この給電板４６は、絶縁状態になされた給電線４８により給電用スイッチ５０を介してプラズマ発生用の例えば１３．５６ＭＨｚの高周波電源５２に接続されており、この電源より下部電極２８に対して高周波電圧を印加することにより、両電極間にプラズマを立てるように構成されている。

【００１７】上記給電用スイッチ５０に対して並列に本発明の特長とする接地用スイッチ手段５４が接続されており、必要に応じてこのスイッチ手段５４を閉じることにより下部電極２８をグランドの電位にし得るように構成されている。また、アルミニウムよりなる基板２２の下面略全体を被って高周波シールド板５６が形成されており、このシールド板５６を接地することによりこれと導通する上記基板２２及び処理容器２０が接地される。

【００１８】そして、上記下部電極２８の下部には、上記ＬＣＤ基板Ｓのロード・アンロード時にこれを押し上げるための複数の押し上げピン５８が設けられている。この押し上げピン５８は下部電極２８の４隅に設けられており、ＬＣＤ基板の４隅を４点で支持するようになっている。図２にも示すようにこの押し上げピン５８は、例えばアルミニウム等の導体よりなる直径が約５mm程度のピン本体６０を有しており、このピン本体６０の先端は、ＬＣＤ基板Ｓの裏面と接触することから球面状に成形されると共に下端部には拡径された基部６２が設け

5

られる。

【００１９】このピン本体６０は、上記下部電極２８に図中上下方向へ貫通して形成されたピン挿通孔６２に遊嵌状態で上下動可能で且つその先端が必要な長さだけ下部電極２８の上面より上方へ突出し得るように構成されている。そのため、上記ピン挿通孔６２は、下部が拡径されていると共にピン本体６０よりも断面形状が僅かに大きくなされており、上記下部電極２８に対して非接触で上下動するようになっている。

【００２０】このピン本体６０の基部６２には、下方に延びる導体よりなる補助棒６４が接続されると共に、この補助棒６４の下端部は、テフロン等の絶縁体６６を介して上下駆動用エアシリンダ１４（図１参照）の作動杆６８に接続されている。この作動杆６８は、４つの各押し上げピン５８に共通に接続されており、１つの上下駆動用エアシリンダ１４により各ピン５８を同時に上下動するようになっている。

【００２１】通常、この押し上げピン５８の下方は常圧の雰囲気に晒されており、これに対して押し上げピン５８の上方の処理室２４は真空状態になることから、これらの間の連通を断つために金属よりなる蛇腹状のベローズ７０が用いられる。すなわち、このベローズ７０は、上記ピン挿通孔６０の下端部にＯリング等のシール部材７２を介して気密に接続された略円筒体状の金属よりなるベローズ収容箱７４内に伸縮可能に収容される。このベローズ７０内には上記補助棒６４が連通され、ベローズ７０の上端は上記ピン本体６０の基部６２に気密に接続されると共にベローズ７０の下端は、金属製の補助部材７６及びＯリング７８を介してベローズ収容箱７４の底部に気密に取り付けられる。また、下部電極２８とピン本体６０とは、ベローズ収容箱７４、金属性の補助部材７６及びベローズ７０を介して導通されており、電気的には同電位となるように構成されている。

【００２２】従って、このベローズ７０の作用により、押し上げピン５８の下方の常圧雰囲気と処理室２４内との連通を断ちつつ押し上げピン５８の上下動を許容するように構成されている。また、上記ベローズ収容箱７４の底部には上記補助棒６４を挿通する挿通孔８０が形成され、この底部には上記補助棒６４の直線上下運動を保証するためのリニアガイド８２が取り付けられている。

【００２３】一方、上記下部電極２８の周縁部にはプラズマをＬＣＤ基板Ｓ上に集中させるフォーカスリング８４が設けられる。また、処理容器２０の側壁には、ＬＣＤ基板Ｓのロード・アンロード時に開閉するゲートベン８６と、図示しない真空ポンプに接続された排気管８８が接続されている。そして、上記上下駆動用エアシリンダ１４、給電用スイッチ５０、接地用スイッチ手段５４及び第１及び第２の流量制御弁３８、４０等の動作は、マイクロコンピュータよりなる制御部９０により制御される。

6

【００２４】次に、以上のように構成された上記装置例に基づいて本発明の使用方法について説明する。図３はＬＣＤ基板処理後の搬出工程のフローを示す図である。まず、処理容器２０の側部に設けたゲートベン８６を開き、搬送アーム１６に支持されたＬＣＤ基板Ｓを処理容器２０内に搬入してこれを下部電極２８の上方に位置させる。そして、上下駆動用エアシリンダ１４を駆動することにより各押し上げピン５８を上昇させて、その先端でＬＣＤ基板Ｓの４隅を突き上げ、搬送アーム１６からの受け渡しを行う。

【００２５】次に、搬送アームを退避させた後に、各押し上げピン５８を降下させてピン本体６０を下部電極２８の表面より下に位置させると、ＬＣＤ基板Ｓは下部電極である載置台２８の載置面２８Ａに載置されることになる。

【００２６】次に、真空ポンプを駆動することにより排気管８８を介して処理容器２０内を真空引きし、ロードロック室からＬＣＤ基板Ｓを処理容器２０内へ搬入する。そして、処理ガス源３４、３６から所定の処理ガス、例えばCF_4及びO_2をそれぞれ３００ＳＣＣＭ及び８５ＳＣＣＭずつ供給し、処理容器２０内を所定の圧力、例えば３５０ｍＴｏｒｒ程度に維持する。そして、給電用スイッチ５０をオンすることによりプラズマ発生用の高周波電源５２から高周波電圧を下部電極２８に印加して上部電極２６と下部電極２８との間の処理室２４にプラズマを立て、例えばエッチング処理を行う。この時、高周波電源５２より供給される電力は、例えば１５００Ｗ程度である。

【００２７】このようにして、プラズマエッチング処理が終了したならば、図３に示すＬＣＤ基板の搬出工程へ移行する。この工程では、ＬＣＤ基板２８を下部電極２８から突き上げる際に剥離帯電現像が生ずることからこの影響を可能な限り抑制するために、例えば押し上げに先立って押し上げピン５８や、下部電極２８を接地するようになっている。

【００２８】すなわち、まず、図３中のＳ１においてプラズマ処理が終了すると給電用スイッチ５０をオフし、下部電極２８への高周波電圧の印加を断ってプラズマの発生を停止させる。そして、所定の時間だけ真空引きを継続して処理容器２０内の残留ガスや反応副生成物をある程度以上排気する。

【００２９】次に、Ｓ２において接地用スイッチ手段５４をオンし、給電線４８及び給電板４６を介して下部電極２８を接地する。この場合、押し上げピン５８のアルミニウム製のピン本体６０は、金属性のベローズ収容箱７４、この底部内側に設けた補助部材７６及びベローズ７０を介して下部電極２８に導通しているので、下部電極２８と同時にピン本体６０もグランド電位となる。尚、高周波電圧の印加時においても、このピン本体６０は下部電極２８と導通していることからこれと同電位と

7

なり、これらの間にプラズマ放電が生ずることはなく、また、ピン本体６０に接続される補助棒６６は、この下端に設けた絶縁体６６によりエアシリンダ１４側と電気的に絶縁されており、高周波電源が短絡することはない。

【００３０】このようにして、押し上げピン５８及び下部電極２８の接地が完了したならば、次に、Ｓ３において上下駆動用エアシリンダ１４を駆動することにより作動杆６８を介して各押し上げピン５８を上昇させ、Ｓ４に示すようにこれによりＬＣＤ基板Ｓの裏面の４隅をピン本体６０の先端と接触させてＬＣＤ基板Ｓ全体を押し上げる。この時、ＬＣＤ基板Ｓが下部電極２８から離れるに際して、ＬＣＤ基板Ｓには剥離帯電現像により電荷が生ずるが、発生した電荷は接地されている押し上げピン５８を介して直ちに逃されてしまい、ＬＣＤ基板Ｓの帯電を抑制することが可能となる。この場合、押し上げピン５８をアルミニウムで形成する場合には、ＬＣＤ基板Ｓ等との導電性を確保するためにピン先端の基板との接触部及び基台部材との接触部分にはアルマイト処理を施さないようにする。

【００３１】またこの場合、下部電極２８自体も予め接地されているので、ＬＣＤ基板Ｓの押し上げ時にＬＣＤ基板Ｓの裏面に生ずる電荷自体の量も抑制することができ、ＬＣＤ基板Ｓの帯電を一層抑制することができる。尚、この場合、ＬＣＤ基板Ｓの電荷の逃げが十分に行われていない場合には、押し上げピン５８の数を増加させて、これを平面的に均等に分散させて設けるようにしてもよい。

【００３２】このようにＬＣＤ基板Ｓの帯電を抑制することにより、この基板自体にパーティクルが付着することもなく、また、帯電の電荷によりＬＣＤ基板表面の素子が破壊されることも防止することができる。更には、ＬＣＤ基板Ｓが帯電していないことから、イオン化している残留ガスや反応副生成物が基板裏面に付着して成膜することも抑制することができ、ＬＣＤ基板の透明度が損なうことも防止することができる。

【００３３】このようにして、ＬＣＤ基板Ｓの押し上げが完了したならば、Ｓ５にてゲートベン８６を開いて押し上げられたＬＣＤ基板Ｓの下方に搬送アームを侵入させ、次にＳ６にて上下駆動用エアシリンダ１４を駆動して各押し上げピン５８を降下させる。すると、押し上げピン５８の先端に支持されていたＬＣＤ基板Ｓは搬送アーム側に受け渡される。そして、Ｓ７にて搬送アームを処理室２４内から退避することにより処理済みのＬＣＤ基板Ｓがアンロードされることになる。以後、同様にして未処理のＬＣＤ基板がロードされて処理されることになる。

【００３４】このように、本実施例においては、処理済みのＬＣＤ基板を押し上げピン５８により下部電極２８から押し上げるに先立って、この押し上げピン５８及び

8

下部電極２８を接地させるようにしたので、剥離帯電現象に起因してＬＣＤ基板の裏面が帯電することを阻止することができ、帯電に伴う種々の問題点が発生することを防止することができる。また、この種の装置は、従来の処理装置に接地用スイッチ手段５４を設けるだけで大幅な設計変更を加えることなく容易に実施することができる。

【００３５】尚、上記実施例にあっては、接地用スイッチ手段５４をオンにして下部電極と押し上げピン５８をともに接地した後に、エアシリンダ１４を駆動して押し上げピンの上昇を開始するようにしたが、これに限定されず、例えば押し上げピン５８に接地用のスイッチ手段を設けて押し上げピンの上昇途中においてこれを接地させるようにしてもよい。

【００３６】図４は上述のように動作する構成を示す図であり、接地用スイッチ手段５４は、押し上げピン５８の金属性の補助棒６４の下端部に設けた金属性の可動接片５４Ａと、この可動接片５４Ａの僅か上方に位置させて上記高周波シールド板５６に取り付け固定した金属性の固定接片５４Ｂとにより構成されており、この補助棒６４が上昇すると上記可動接片５４Ａと固定接片５４Ｂとが接触して上記ピン本体６０及びこれを導通する下部電極２８とを接地し得るようになっている。この場合、動作前の可動接片５４Ａと固定接片５４Ｂとの間の距離Ｌ１はピン本体６０の上端と下部電極２８の上面との間の距離Ｌ２よりも小さく設定されており、押し上げピン５８を上昇させた時に、まず、可動接片５４Ａと固定接片５４Ｂとが接触してピン本体６０が接地され、その後、ピン本体６０の先端がＬＣＤ基板Ｓの裏面に接触するようになっている。尚、両接片５４Ａ、５４Ｂの接触後においても押し上げピン５８の上昇を許容するために、これら両接片５４Ａ、５４Ｂの少なくとも一方は可撓性が持たせてある。このような構成によれば、接地用スイッチ手段５４の開閉動作を制御部９０により行う必要がなく、単に押し上げピン５８の昇降動作に連動させて行うことができるので、制御が容易となる。

【００３７】また、この実施例においては、押し上げピン５８とＬＣＤ基板Ｓとの接触に先立って可動接片５４Ａと固定接片５４Ｂとを接触させて押し上げピン５８を接地するようにしたが、これに限定されず、押し上げピン５８とＬＣＤ基板Ｓとが接触した後に両接片５４Ａ、５４Ｂを接触させてピン５８を接地するようにしてもよい。この場合には、剥離帯電現象により発生する電荷の量が先の実施例よりも僅かに多くなると思われるが、この場合にも発生した電荷はこの後、間もなく接地される押し上げピン５８を介して直ちに逃げるので先の実施例と略同様な作用効果を発揮することができる。

【００３８】また、この実施例においては発生した電荷が放電する程に大きい場合にあっても、この放電現象は押し上げピン５８とＬＣＤ基板Ｓが接触する時ではな

9

く、両接片５４Ａ、５４Ｂが接触する時に発生することになるのでＬＣＤ基板Ｓにダメードを与えることもない。

【００３９】以上の実施例にあっては下部電極２８にプラズマ発生用の高周波電源を印加する場合について説明したが、これに限定されず、上部電極２６にプラズマ発生用の高周波電圧を印加する場合にも適用し得るのは勿論である。この場合には、通常、下部電極及び押し上げピン５８は常に接地されているので、ＬＣＤ基板の裏面との導通を良くするために、例えば押し上げピン５８のピン本体６０の先端に通常形成されているアルマイト被膜を除去するように構成する。

【００４０】また、ＬＣＤ基板としては矩形状のものに限定されず、例えば水晶（石英）ウエハ等の誘電体よりなる被処理体について全て適用し得るのは勿論である。更には、本発明はプラズマエッチング装置に限定されず、イオンプレーティング装置、ＣＶＤ装置等の他の処理装置にも同様に適用し得る。

【００４１】

【発明の効果】以上説明したように、本発明の処理装置及びその使用方法によれば、次のように優れた作用効果を発揮することができる。被処理体の押し上げに先立って押し上げピンや下部電極を接地させるようにしたので、剥離帯電現象によって被処理体に生ずる電荷を直ちに逃すことができる。従って、製品の欠陥の原因となるパーティクルの付着や電荷により素子の破壊を未然に防止できるのみならず、残留ガスや反応副生成物の付着も防止して透明度を損なうこともなくすことができる。

【図面の簡単な説明】

10

【図１】本発明に係る処理装置の一例を示す断面図である。

【図２】図１に示す処理装置において用いられる押し上げピンの構造を示す拡大図である。

【図３】被処理体の搬出工程のフローを示す図である。

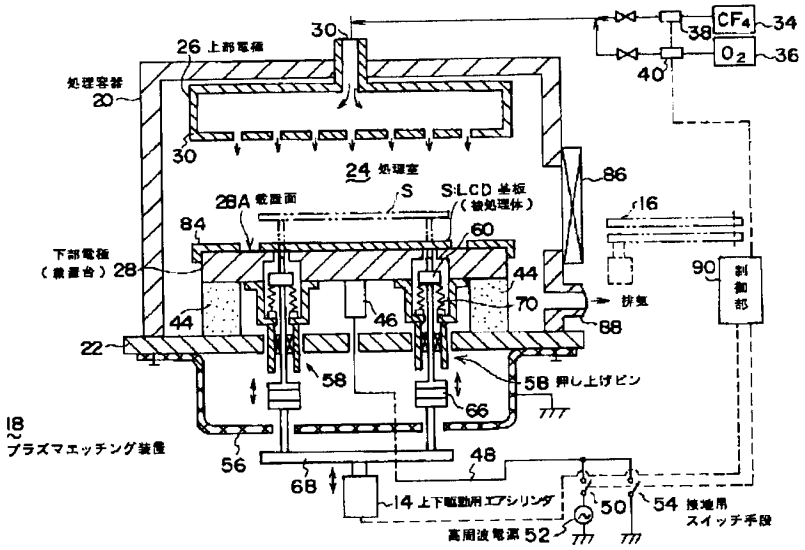
【図４】接地用スイッチ手段を設けた押し上げピンの構造を示す拡大図である。

【図５】従来の処理装置を示す概略構成図である。

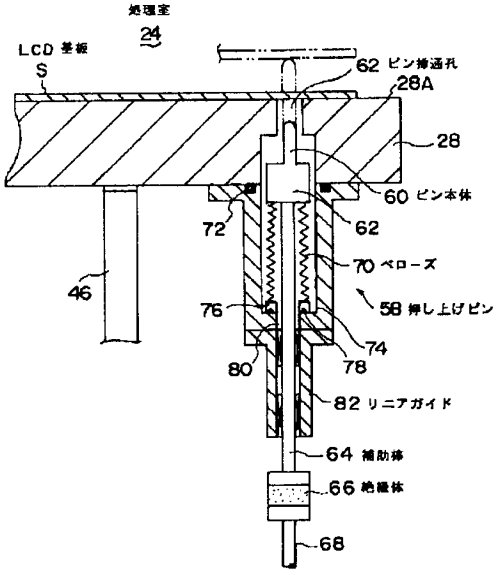
【符号の説明】

	１４	上下駆動用エアシリンダ
	１６	搬送アーム
	１８	プラズマエッチング装置（処理装置）
	２０	処理容器
	２４	処理室
	２６	上部電極
	２８	下部電極（載置台）
	２８Ａ	載置面
	５０	給電用スイッチ
	５２	高周波電源
	５４	接地用スイッチ手段
	５８	押し上げピン
	６０	ピン本体
	６４	補助棒
	６６	絶縁体
	７０	ベローズ
	７４	ベローズ収容箱
	７６	金属性の補助部材
	８２	リニアガイド
	Ｓ	ＬＣＤ基板（誘電体よりなる被処理体）

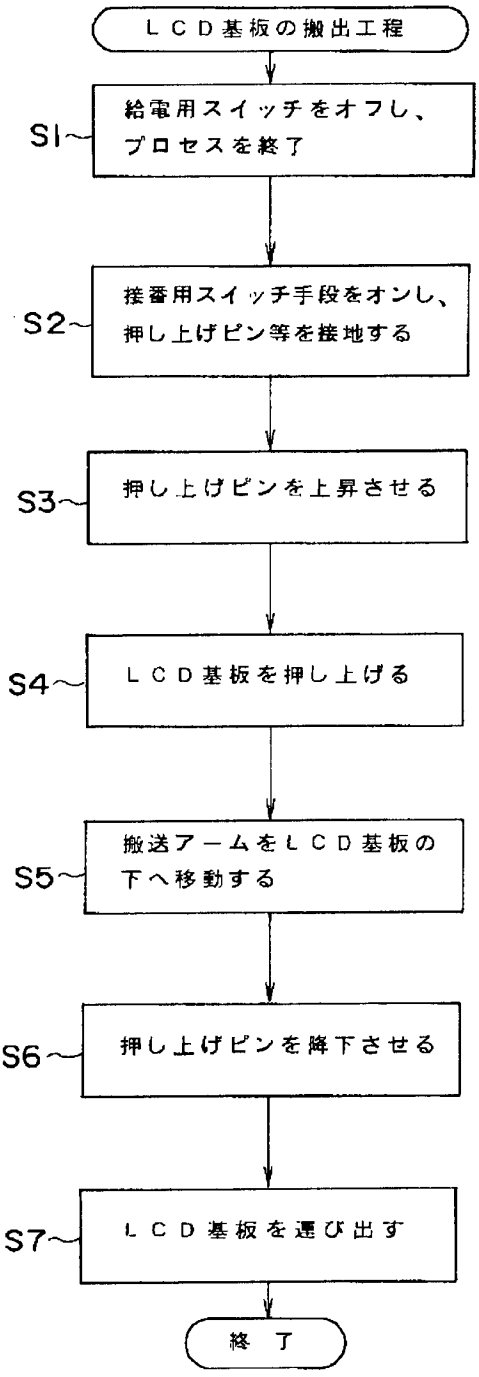
【図１】



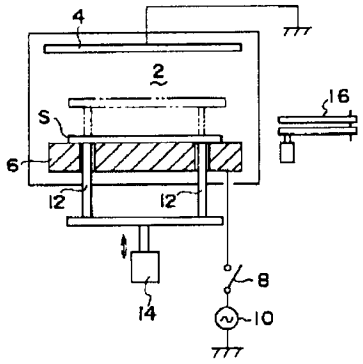
【図2】


処理室
24
LCD 基板
S
62 ピン挿通孔
28A
28
60 ピン本体
72
62
70 ベローズ
46
58 押し上げピン
76
74
80
78
82 リニアガイド
64 補助棒
66 絶縁体
68

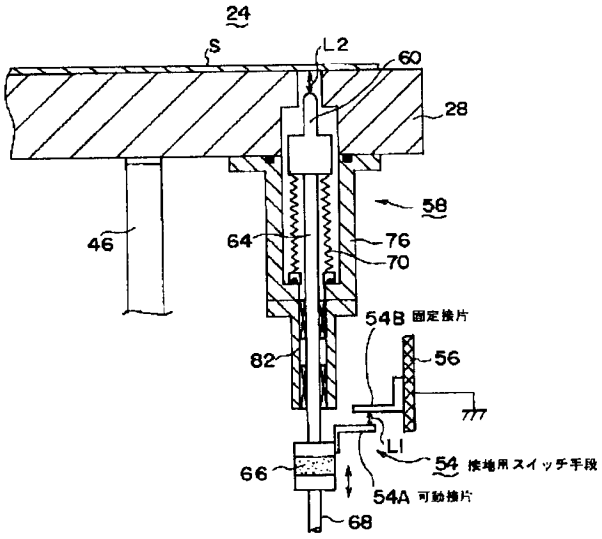
【図3】


ＬＣＤ基板の搬出工程
S1
給電用スイッチをオフし、プロセスを終了
S2
接番用スイッチ手段をオンし、押し上げピン等を接地する
S3
押し上げピンを上昇させる
S4
ＬＣＤ基板を押し上げる
S5
搬送アームをＬＣＤ基板の下へ移動する
S6
押し上げピンを降下させる
S7
ＬＣＤ基板を運び出す
終　了

【図5】


4
2
16
S
6
12
12
8
14
10

【図４】


24
S
L2
60
28
58
46
64
76
70
54B 固定接片
82
56
L1
54 接地用スイッチ手段
66
54A 可動接片
68